

REMARKS

CLAIM OBJECTIONS

Claim 22 was objected to because the word "continuous" should have been -- continuously --. With the present amendment, Applicants have amended claim 22 to correct this error and wish to thank the Examiner for bringing it to Applicants' attention.

SECTION 101 REJECTIONS

Claims 14-22 were rejected under 35 U.S.C. §101 for being directed to non-statutory subject matter. In particular, it was said that claim 4 is drawn to a program per se and as such was non-statutory subject matter.

With the present amendment, claim 14 has been amended to change "computer-readable medium having computer-executable instructions for performing steps" to "computer storage medium encoded with computer-executable instructions that when executed by a computer cause the computer to perform steps."

As amended, claim 14 is not directed to a data structure per se or to a program listing. Instead, claim 14 is directed to a computer storage medium that defines structural and functional interrelationships between the computer-executable instructions stored thereon and the hardware components that allow the functionality of the computer-executable instructions to be realized.

Also, by changing "computer-readable medium" to "computer storage medium", the amendment to claim 14 limits the claim to tangible computer-readable media. In the specification on page 7, lines 10-12, computer-readable media was said to comprise computer storage media and communication media. Computer storage media was further said to include RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other optical disk storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or other media which can be used to store the desired information and which can be accessed by computer 110. (See page 7, lines 17-25). Communication media, on the other hand, were said to include instructions and data structures in a modulated data signal

such as a carrier wave or other transport mechanism. (See page 7, lines 25-30). Thus, in the specification, a distinction is made between computer storage media and communication media with computer storage media being directed to tangible computer-readable media and communication media said to include carrier waves. Since a computer storage medium is directed to a tangible computer-readable medium and not carrier waves, the amendments to claim 14 exclude communication media, such as carrier waves, and thus make claim 14 statutory.

#### SECTION 102 AND SECTION 103 REJECTIONS

##### CLAIMS 1-13

Claims 1-4 and 8-13 were rejected under 35 U.S.C. §102(b) as being anticipated by Dusan (“Statistical Estimation of Articulatory Trajectories from the Speech Signal Using Dynamical and Phonological Constraints,” 2000). Claims 5-7 were rejected under 35 U.S.C. §103(a) as being unpatentable over Dusan in view of Takizawa et al. (U.S. Patent 5,361,324, hereinafter Takizawa).

Independent claim 1 provides a method of tracking vocal tract resonance frequencies in a speech signal. The method comprising defining a state equation that is linear with respect to a past vocal tract resonance vector and that predicts a current vocal tract resonance vector. An observation equation is defined that is linear with respect to a current vocal tract resonance vector and that predicts at least one component of an observation vector. Defining the observation equation comprises defining a linear approximation to the product of two functions that are each respective linear approximations of two functions that are each non-linear with respect to the vocal tract resonance vector. The state equation, the observation equation, and a sequence of observation vectors are then used to identify a sequence of vocal tract resonance vectors, each vocal tract resonance vector comprising at least one vocal tract resonance frequency.

With the present amendment, the limitations of claim 5 have been added to claim 1. Support for the amendment can be found on page 16.

As amended, independent claim 1 is not shown or suggested in the combination of cited art. In particular, none of the cited references show or suggest forming a linear approximation from the product of two functions that are each respective linear approximations of two non-linear functions with respect to the vocal tract resonance vector. Although Takizawa shows two non-linear functions in column 6, lines 55-60, it does not show or suggest forming a linear approximation for either of the two non-linear functions. Dusan suggests forming a linear approximation of a single non-linear function in an observation function by using a first order approximation of the Taylor series expansion of the original non-linear observation equation. Dusan, however, does not show or suggest that the non-linear observation equation would consist of two non-linear functions or that the two non-linear functions should be approximated by two linear functions the product of which would be approximated as a linear function. Instead, Dusan suggests forming a Taylor series expansion of a single non-linear function.

In addition, simply combining Takizawa and Dusan would result in Dusan calculating the Taylor series expansion of the entire functions shown in Takizawa. There is no suggestion in either reference for performing the additional steps of determining linear approximations of the exponential part of Takizawa and the cosine part of Takizawa and then forming a linear approximation of the product of those linear approximations.

By performing the multiple levels of linear approximations, the present invention makes it possible to use the complex function for the LPC parameters in a Kalman filter to identify continuous values for vocal tract resonance. Neither Takizawa nor Dusan show or suggest the use of these multiple levels of linear approximations to achieve this result. As such, the combination of Dusan and Takizawa does not show or suggest the invention of claim 1 or claims 2, 3, and 6-13, which depend therefrom.

#### CLAIMS 14-22

Independent claim 14 provides a computer storage medium encoded with computer-executable instructions that when executed by a computer cause the computer to perform steps. The steps include using an estimate of at least one vocal tract resonance

component to select a linear approximation to a function that is non-linear with respect to the vocal tract resonance component. The estimate of the at least one vocal tract resonance component is also used to select a second linear approximation to a second function that is non-linear with respect to a second vocal tract resonance component. The linear approximation and the second linear approximation are used to define an observation equation that is then used with at least one observed vector to re-estimate the vocal tract resonance component.

With the present amendment, claim 19 has been added to claim 14. As amended, claim 14 is not shown or suggested in Dusan and Takizawa. In particular, the combination of references does not show or suggest selecting a linear approximation for two separate functions and using the two linear approximations to define observation equations.

Takizawa does not show or suggest forming a linear approximation of either of its functions. Dusan only suggests determining a linear approximation of a single function. It does not determine linear approximations of two separate functions and does not use two linear approximations to define an observation equation. Instead, it uses a single Taylor series expansion of a single function. Since neither Takizawa nor Dusan show or suggest forming two linear approximations of two separate non-linear functions and using those linear approximations to define an observation equation, their combination does not show or suggest the invention of claim 14 or claims 15-18 and 20-22 which depend therefrom.

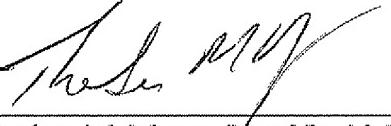
#### CONCLUSION

In light of the above remarks, claims 1-3, 6-18 and 20-22 are in form for allowance. Reconsideration and allowance of the claims is respectfully requested.

The Director is authorized to charge any fee deficiency required by this paper or credit any overpayment to Deposit Account No. 23-1123.

Respectfully submitted,

WESTMAN, CHAMPLIN & KELLY, P.A.

By: 

Theodore M. Magee, Reg. No. 39,758  
900 Second Avenue South, Suite 1400  
Minneapolis, Minnesota 55402-3319  
Phone: (612) 334-3222 Fax: (612) 334-3312

TMM:sew